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Options to Implement a Regulatory Framework to Accommodate Geological Storage of CO₂ in Saskatchewan

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Abstract

This paper discusses three options to implement a regulatory framework to accommodate geological storage of CO₂ (GSC) in Saskatchewan, Canada. These options are

- Utilization of current legislation following the same pattern as for the enhanced oil recovery project in Weyburn oil field, Saskatchewan, Canada.
- Amendment of the Oil and Gas Conservation Act (OGCA) and its existing regulations and the creation of protocols and/or standards that support those amendments.
- Creation of new legislation (acts and regulations)

We start by describing the current situation in Canada and Saskatchewan and the driving forces that motivate the implementation of greenhouse gas emissions reduction plans. Next we proceed to explain the foremost implications in adopting each of the three identified options based on four criteria: economic, technical, political, and administrative. Our analysis shows that the most convenient option at the moment is the amendment of existing legislation and the development of new protocols.

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1. Introduction

At the United Nations Climate Change Conference 2009 in Copenhagen, Canada submitted a reduction target of 17% of greenhouse gases (GHG) emissions below 2005 levels by 2020. The implementation of this obligation lies, in part, within provincial jurisdiction. The Government of Saskatchewan, for its part, committed to reducing its GHG emissions 20% below 2006 levels by 2020, or 2% per year from 2010 to 2019.

On May 20, 2010, the *Management and Reduction of Greenhouse Gases Act* (Bill 126) was given Royal Assent in the Saskatchewan Legislative Assembly. It is intended that the Act will be proclaimed once its draft Regulations are finalized. This Act provides a framework for the control of GHG emissions

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and also establishes various non-profit corporations that will invest in research and development of technologies to reduce these emissions. The Saskatchewan government, through its Ministry of Environment, is currently in consultations with various stakeholders on the scope of the proposed regulations that would support implementation of the Act. These regulations apply to large industrial GHG emitting facilities (regulated emitters) that produce over 50,000 tonnes CO₂e annually, which in Saskatchewan counts for 29 industrial businesses.

Saskatchewan, like Alberta, is focused on carbon capture and sequestration (CCS) as the primary technology to reduce GHGs. It is generally accepted within the province that both capture of CO₂ streams and their transportation may demand some amendments to current provincial legislation. However, this is not the case for the Geologic Storage of CO₂ (GSC). Although there are many industrial cases of injecting CO₂ in depleted reservoirs to recover remaining oil (Enhanced Oil Recovery, CO₂-EOR), no GSC projects have been implemented in the province. In other words, in Saskatchewan there is a regulatory framework for CO₂-EOR projects, but there is no regulatory framework for recognising storage.

This paper discusses three options for implementing a regulatory framework to accommodate GSC in Saskatchewan:

- Utilization of current legislation following the same pattern as for the Weyburn project (Saskatchewan's major CO₂ based enhanced oil recovery project)
- Amendment of the Oil and Gas Conservation Act (OGCA) and its existing regulations and the creation of protocols and/or standards that support those amendments.
- Creation of new legislation (acts and regulations)

Before establishing the provincial commitment, the province made a study in 2009 of the economic effects of reducing GHGs [1]. This study identified GHG emissions by sector. Most of the GHGs emitted in the province in 2008 were CO₂ and the main sector corresponded to oil and gas production and processing with 34%, followed by electricity and agriculture with 22% and 17% respectively (Figure 1). These three sectors account for almost three quarters of the total provincial GHG emissions. Additionally, it is interesting to see the per-capita GHG emission in the province and compare it with other jurisdictions. According to the World Resources Institute, the average per-capita CO₂e emission in the world was estimated at 5.6 tonnes per year in 2000. An average American citizen emits 24.5 tonnes per year and a Canadian, 22.1 [2]. Saskatchewan, on the other hand, emits an average of more than 70 tonnes of CO₂e per year per person (Table 1).

Table 1: Emissions, Economy, Energy, and Climate in Saskatchewan (Source [3])

Emissions, Economy, and Energy	1990	2004	2005	2006	2007	2008
Population (000s)	1,008	997	994	992	1,000	1,016
Change Since 1990 (%)	NA	-1.0%	-1.4%	-1.5%	-0.8%	0.8%
GDP (millions)	27,793	37,741	38,970	38,520	39,896	41,583
Change Since 1990 (%)	NA	35.8%	40.2%	38.6%	43.5%	49.6%
Total GHG (Mt)	43.4	71.7	72.3	71.3	74.0	75.0
Change Since 1990 (%)	NA	65.0%	66.4%	64.3%	70.5%	72.8%
Annual Change (%)	NA	NA	0.8%	-1.3%	3.8%	1.4%
GHG Intensity (Mt/GDP)	1.56	1.90	1.85	1.85	1.86	1.80
GHG Per Capita (tonnes/person)	43.1	71.9	72.7	71.9	74.0	73.8
Primary Energy Production (TJ)	941,825	1,509,386	1,481,666	1,490,997	1,449,827	1,460,045
Change Since 1990 (%)	NA	60.3%	57.3%	58.3%	53.9%	55.0%

Notes: GDP in \$ 2002

NA = Not applicable

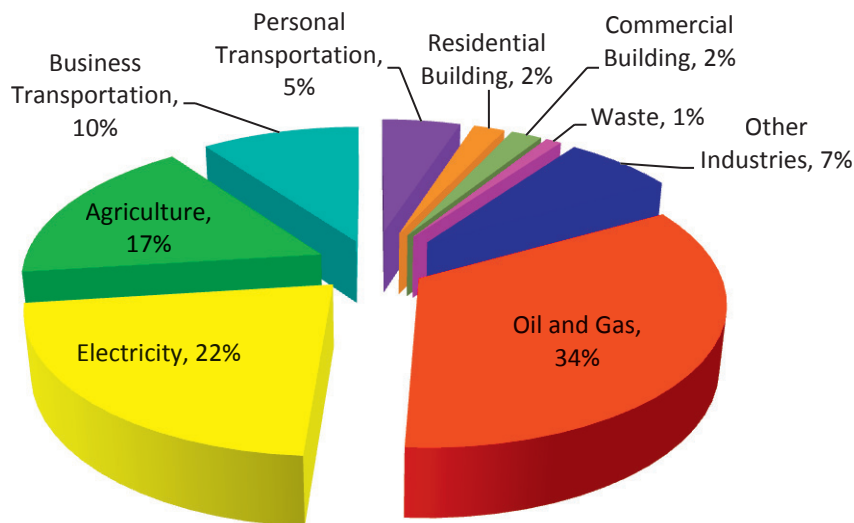


Figure 1: Sectoral GHG emissions in Saskatchewan in 2009 (Source [1])

The political and socio-economic implications for deploying CCS in Saskatchewan would also affect energy prices. For example, the provincial government, in an analysis of implementing a 20% reduction target by 2020 versus the 32% target that had been a topic of discussion, reached several key conclusions:

- That the cost of implementation would reduce costs to the provincial economy by some \$700 million over the projected time period of 2010 to 2019, an average of \$65 million per year.
- That the implementation would result in the provincial rate payers seeing an increase in electrical rates based on the assumption of storage of CO₂. Offsetting revenues from the sale of CO₂ into the EOR market may well reduce, or even eliminate, any increased burden to rate payers.

Finally, an important detail of Bill 126 is the assumption of a Canada/Saskatchewan Equivalency Agreement. This Agreement, if allowed, would permit provincial administration of the federal climate change plan assuming the province offers equivalent or higher standards for emissions reductions. This Agreement may also facilitate the creation of a carbon market, particularly within the jurisdiction of Saskatchewan. Alberta is seeking similar equivalency and has created its own internal market for offsets. To this point, this is not a shared market.

2. Alternatives/Options

2.1. Utilization of current legislation following the same pattern as for the Weyburn project

Currently there is no regulatory framework for GSC in Saskatchewan. However, this province is worldwide recognized for the Weyburn Enhanced Oil Recovery Project. Discussions between PanCanadian Petroleum and the provincial oil and gas regulatory agency began in the mid 90s with implementation of the project in 2000. In 2005, Apache Canada also began injecting CO₂ for EOR at adjacent Midale field [5].

The enhanced oil recovery projects are covered by enhanced oil recovery regulations under the provincial Oil and Gas Conservation Act (OGCA). Under this act, the liability for the field is held in perpetuity by the lease holder(s) and the regulations are those covering all enhanced oil recovery projects in the province. Financial terms for the project were negotiated separately, but demonstrated the willingness of the state to share part of the risk of this innovative project.

The Weyburn Project uses the following federal and provincial legislation for compliance [6]:

- The Canadian Environmental Assessment Act (through the National Energy Board, NEB)
- The Oil and Gas Conservation Act (OGCA)
- The Reclaimed Industrial Sites Act (RISA)
- The Surface Rights Acquisition and Compensation Act (SRACA)
- The Pipelines Act
- The Crown Minerals Act
- The Clean Air Act
- The Environment Assessment Act (EAA)
- The Environmental Management and Protection Act (EMPA)
- The Occupational Health and Safety Act (OHSA)
- The Saskatchewan Watershed Authority Act
- Bill 126 (pending to be proclaimed)

2.2. Amendment of the Oil and Gas Conservation Act (OGCA) and its regulations

The province has been enjoying the benefits of high prices for commodities since 2007. In the case of the oil and gas sector, in 2010 its sales totalled \$10.8 billion, and provided approximately \$1.7 billion in revenue for the province. According to the Ministry of Economy, Saskatchewan has approximately 40 billion barrels of oil in-place that is a target for the use of new EOR methods, included CO₂ flooding. Consequently, there is a market (industrial demand) for CO₂ in Saskatchewan.

Currently there are two projects using CO₂-EOR: Weyburn operated by Cenovus Energy, and Midale, operated by Apache Canada. The estimated potential for storing CO₂ in these two projects is calculated at 40 million tonnes over a period of 25 years. This does not take into account the potential for additional storage, with no incremental oil that could occur in the field should economic conditions allow. These two projects buy and inject about 3 million tonnes of CO₂ annually from North Dakota, U.S. [7]

As for industrial supply of CO₂, SaskPower is currently adding CO₂ capture to one of its older generating units at Boundary Dam, its largest coal fired station. The project includes a repowering of one of the electrical generating units (150 MW) and the addition of sulphur and mercury capture ahead of the CO₂ capture unit. This project will capture about 1 million tonnes of CO₂ per year. The Federal Government committed \$240 million for the capture portion of this project and SaskPower will provide over \$1 billion additionally for the entire project (repowering, criteria air contaminant removal and CO₂ capture) [8].

To take advantage of this route forward for including GSC into law, the authors believe that the province would need to evaluate and possibly amend a number of provincial regulations, and possibly the acts that allow these regulations force in law. These acts and regulations would include:

- The Oil and Gas Conservation Regulations 1985 (with amendments through to 2000) provide minimum standards for the drilling, completion and abandonment of wells. It also provides standards for the collection of relevant data from drilling, production and for the disposal of saltwater and other oilfield wastes.
- The Mineral Industry Environmental Protection Regulations 1996 provides standards for the development of a disposal facility, including a list of minimum informational requirements
- The Saskatchewan Watershed Authority Act 2005 defines ground water as property of the Crown, regardless of surface and mineral ownership.
- The Crown Minerals Act 1985 refers to the ownership by the Crown of spaces occupied by or formerly occupied by Crown minerals. The Act also authorizes the Crown to enter into agreements to lease pore space.
- The Surface Rights Acquisition and Compensation Act 2004 allows mineral rights holders to access the surface areas necessary to extract the resource thereby superseding the normal right of surface owners to control access.

The most important gaps for this option that need to be addressed in the regulatory framework could include:

- Ownership of the pore space in Crown lands. Although The Crown Minerals Act 1985 makes reference to the ownership of pore space to the Crown, it is not completely clear and this act may need further clarification. Alberta set an example with the discussion and development of the Bill 24. With this bill, Alberta owns subsurface pore spaces where CO₂ is stored and assumes long-term liability for injected CO₂ once project operators provide data that the gas is safely contained. It also creates a special fund financed by CCS operators that would pay for future monitoring of underground carbon dioxide storage sites and any necessary remediation.
- Transfer of Responsibility or Long-Term Stewardship: Because of the long timescale involved in GSC, the ultimate responsibility for the stored gas should rest with governments. Furthermore, the assurance of permanent storage is only based in mathematical models. The Government should accept the responsibility only when the company has proved, by reasonable evidence that the stored volumes are safe based on sound scientific recommendations. As reference, the IPCC accepts up to annual leakage rates of not higher than 0.01% of the injected CO₂ [9]
- Monitoring, measurement, verification and accounting (MMVA) in order to predict the fate of the injected CO₂. This component also is useful for accounting carbon credits as well as for remedial actions in case of incidents. It should be noted that the frequency of monitoring will probably decrease with time since the risk of leakage reduces with time due to natural physical-chemical sequestration processes in the reservoirs.
- Third-party auditing for certifying the containment of CO₂ in geologic reservoirs. The adoption of this regulation should help in gaining public acceptance for CCS projects. This regulation should not affect the oversight of the Ministries of Energy and Environment and may not be required once the regulatory entities have obtained enough experience in the CCS technology.
- Additionally, there are other gaps that can include issues about the purity of CO₂, required documentation, environmental impact assessment for CCS projects, among other requirements.

2.3. Creation of new legislation (acts and regulations)

The creation of new legislation for CCS (GSC included) for Saskatchewan has advantages and disadvantages:

- It would provide a legislative body for this technology avoiding potential ambiguities in the case of contradiction with other energy and environment related acts and regulations.
- CCS legislation would allow the creation of specific technical components such as the Transfer of Responsibility (ToR), liabilities, and measurement, monitoring, verification and accounting (MMVA).
- The main problem with developing a new legislation for CCS is related to resource constraints, including time. A new CCS legislation also requires amendments of existing regulations.

Figure 2 illustrates the common phases for a GSC project with some illustrative time frames for each stage. The regulatory framework should make amendments to the existing legislation in accordance with the GSC phases.

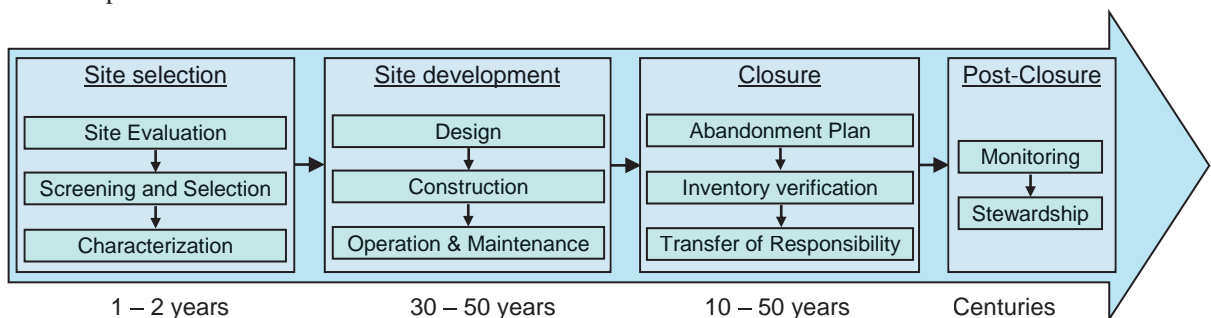


Figure 2: Phases of a GSC projects (Source [10])

3. Criteria

The policy goal for implementing a regulatory framework is a combination of economic and environmental criteria. The Government of Saskatchewan has a goal to reduce its GHG emissions in harmony with the Federal commitment. At the international level it is considered that the adoption of CCS may reduce 20% of the GHG emissions with a significant reduction in the impact of the global economy. Without the use of CCS, meeting the long term targets established in the IEA model would cost an additional 70%. The remaining percentage is distributed between conservation, energy efficiency, renewable energy, and nuclear [11].

3.1. Economic criteria

The success (or failure) of adopting a scheme for a regulatory framework for GSC may be measured by the corresponding net volumes of CO₂e stored by using CCS. Based on the rate of growth of GHG emissions for the period 2004-2008, in 2020 Saskatchewan would produce an estimated 18.5% more GHGs or 83.7 million tonnes of CO₂e per year (business as usual). If Saskatchewan wants to reach the goal of a 20% reduction in emissions from 2006, the emissions should not be higher than 57.04 million tonnes of CO₂e. Consequently there would be a gap of about 26.6 million tonnes of CO₂e over the next 8 years requiring an incremental reduction of 2.7 million tonnes annually. This last figure is for the total GHG emissions. The target for applying GSC is located in the Oil and Gas and the Electricity generation sectors, which combined represent 56% of Saskatchewan GHG emissions requiring about 1.5 million tonnes of CO₂e incrementally per year (Figure 3) from these sectors. This volume one year increment is half of the current injection in Weyburn and Midale (3 million tonnes per year), but this would need to be added every year to reach the target. By 2020, approximately 4 to 5 Weyburn-Midale equivalents would need to be added to the provincial economy.

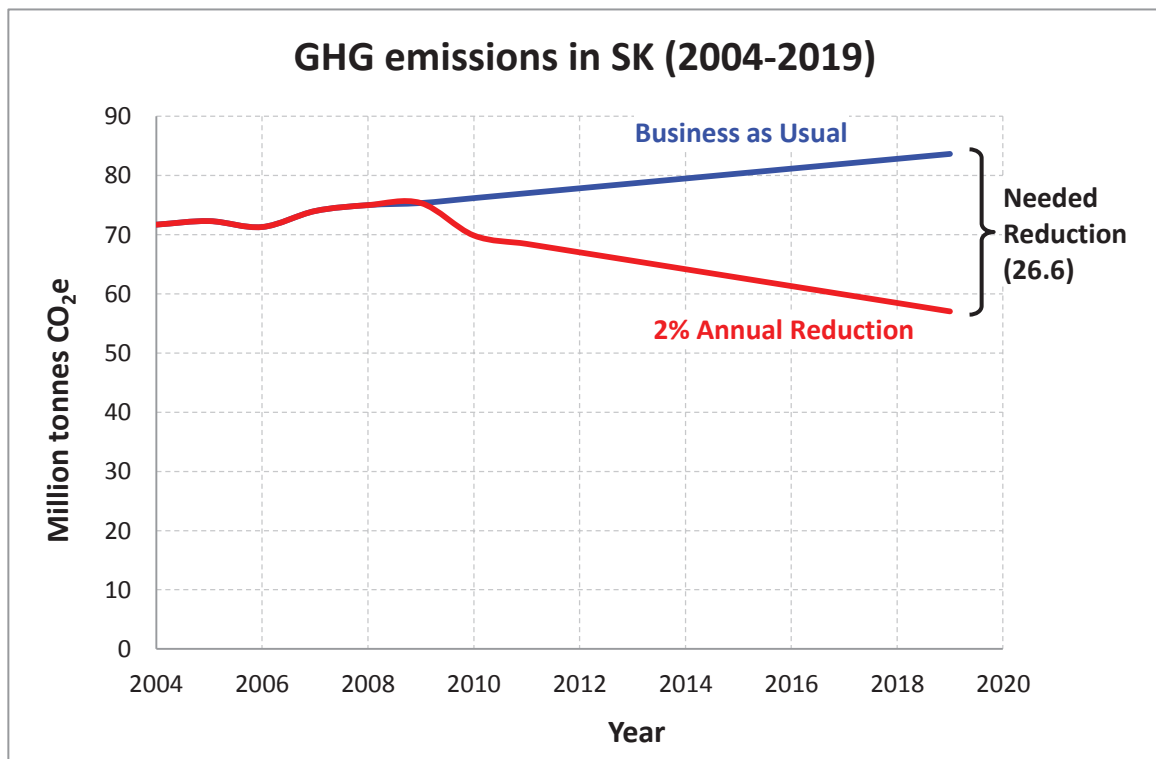


Figure 3: GHG emissions in SK –business as usual scenario (2004-2019)

The CO₂ stored at Weyburn and Midale, from an environmental and accounting perspective, do not count as reduction of greenhouse gases in Canada or Saskatchewan, since the capture is undertaken in North Dakota, USA. The question becomes one of the ability of the Saskatchewan oil industry to create a demand for these incremental volumes of CO₂ should they become available from CO₂ capture from a variety of point sources. A natural benefit for capturing and utilising or storing CO₂ in this province is the creation of new jobs and, potentially, the local or interprovincial trade of carbon offsets.

A study prepared for the Ministry of Environment compared the estimated cost increases for four scenarios to meet GHG reduction targets in the period 2010 - 2020 [4]. The scenarios were set at 20% and 32% reduction targets with and without an equivalence agreement. This study found that establishing a 20% GHG emission reduction target from 2006 level by 2020 would generate large cost saving for the economy, compared to 32% target. The 20% target was estimated to reduce industrial production costs by \$700 million during 2010 - 2020 period, or \$65 million annually with equivalence agreement when compared with the 32% target [4].

3.2. Technical criteria

CCS is a substantial part of fighting Climate Change since it helps greatly in the transition to cleaner sources of energy. The GSC is the most critical component of CCS because of its large capacity. Although CO₂-EOR technology has been working successfully in North America for the last 30 years, the expected CO₂ volumes for CCS are larger than can be accommodated by EOR alone. The regulatory framework for CO₂-EOR definitely contributes to the regulatory framework for GSC, but there remain some gaps that need to be addressed.

3.3. Political criteria

There are two main reasons for considering GSC from a political perspective:

- It will sustain the economic growth of Saskatchewan: According to the Ministry of Economy, there are at least 40 billion barrels of oil-in-place that need EOR techniques to improve overall recovery, CO₂ flooding included. Utilizing CO₂ for recovering remaining oil while benefiting the environment is good business.
- Interprovincial trade of carbon credits: When Boundary Dam CCS Project is finished; there will be an annual supply of 1 million tonnes of CO₂. Currently both Weyburn and Midale buy from North Dakota and inject an average of 3 million tonnes of CO₂ annually. As was discussed previously, this volume cannot be accounted as reduction of GHG for Saskatchewan because capture is not done in its territory and transfer of credits from the US is not recognised. By 2020, Saskatchewan needs a net GHG reduction of 26.6 million tonnes of CO₂ from a business as usual case in order to achieve its commitment of a reduction of 20% from 2006 levels. Consequently, there is a niche market for CO₂ in Saskatchewan with a volume of about 1.7 to 2 million tonnes annually and incrementally. This amount, if not captured in Saskatchewan, can be bought from other provinces and accounted as reduction for the province.

3.4. Administrative criteria

Bill 126 creates new departments at the Ministry of Environment. The Office of Climate Change will most likely have jurisdiction over the implementation of the GSC regulatory framework together with the Ministry of Economy. Bill 126 also creates a Fund, financed by a charge on every tonne of CO₂ emitted over the target levels for the 29 large emitters. The money moved to the technology fund will be available to the emitters paying into the fund for a period of five years to finance CO₂ reduction projects. Money in the fund not utilised within the time allotted will move to other funds to finance such activities as research and development (R&D) for energy-related projects.

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